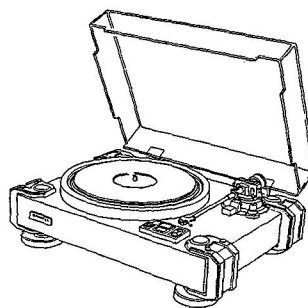


# Service Manual

**PIONEER**  
The future of sound and vision.



## Original

ORDER NO.  
ARP 1463

STEREO TURNTABLE

# PL-90

- This service manual is applicable to the KUT/CA type.

## CONTENTS

1. SAFETY INFORMATION .....	2	6. SCHEMATIC DIAGRAM .....	11
2. SPECIFICATIONS .....	3	7. P.C. BOARDS CONNECTION DIAGRAM .....	13
3. FRONT PANEL FACILITIES .....	4	8. ELECTRICAL PARTS LIST .....	16
4. PACKING .....	5	9. ADJUSTMENTS .....	18
5. EXPLODED VIEWS AND PARTS LIST .....	6	10. CIRCUIT DESCRIPTIONS .....	19

**PIONEER ELECTRONIC CORPORATION** 4-1, Meguro 1-Chome, Meguro-ku, Tokyo 153, Japan  
**PIONEER ELECTRONICS SERVICE INC.** P.O. Box 1760, Long Beach, California 90801 U.S.A.  
**PIONEER ELECTRONICS OF CANADA, INC.** 505 Cochrane Drive, Markham, Ontario L3R 8E3 Canada  
**PIONEER ELECTRONIC [EUROPE] N.V.** Keetberglaan 1, 2740 Beveren, Belgium  
**PIONEER ELECTRONICS AUSTRALIA PTY. LTD.** 178-184 Boundary Road, Braeside, Victoria 3195, Australia TEL: [03] 580-9911

FO © SEPT. 1987 Printed in Japan

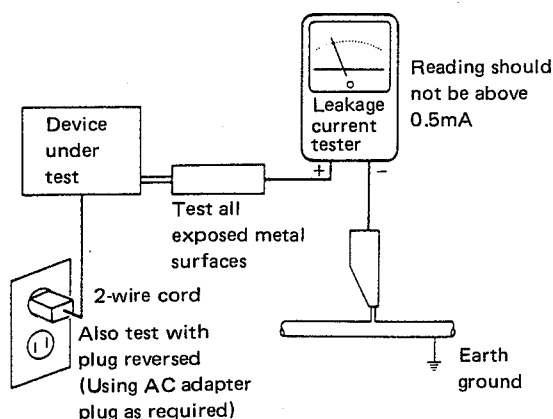
# 1. SAFETY INFORMATION

## 1. SAFETY PRECAUTIONS

The following check should be performed for the continued protection of the customer and service technician.

### LEAKAGE CURRENT CHECK

Measure leakage current to a known earth ground (water pipe, conduit, etc.) by connecting a leakage current tester such as Simpson Model 229-2 or equivalent between the earth ground and all exposed metal parts of the appliance (input/output terminals, screwheads, metal overlays, control shaft, etc.). Plug the AC line cord of the appliance directly into a 120V AC 60Hz outlet and turn the AC power switch on. Any current measured must not exceed 0.5mA.



AC Leakage Test

ANY MEASUREMENTS NOT WITHIN THE LIMITS OUTLINED ABOVE ARE INDICATIVE OF A POTENTIAL SHOCK HAZARD AND MUST BE CORRECTED BEFORE RETURNING THE APPLIANCE TO THE CUSTOMER.

## 2. PRODUCT SAFETY NOTICE

Many electrical and mechanical parts in the appliance have special safety related characteristics. These are often not evident from visual inspection nor the protection afforded by them necessarily can be obtained by using replacement components rated for voltage, wattage, etc. Replacement parts which have these special safety characteristics are identified in this Service Manual.

Electrical components having such features are identified by marking with A on the schematics and on the parts list in this Service Manual.

The use of a substitute replacement component which does not have the same safety characteristics as the PIONEER recommended replacement one, shown in the parts list in this Service Manual, may create shock, fire, or other hazards.

Product Safety is continuously under review and new instructions are issued from time to time. For the latest information, always consult the current PIONEER Service Manual. A subscription to, or additional copies of, PIONEER Service Manual may be obtained at a nominal charge from PIONEER.

2. SPECIFICATIONS

**Motor and Platter**  
Motor ..... Quartz PLL DC Hall Motor  
Drive System ..... Direct drive  
Speeds ..... 33-1/3 and 45 rpm  
Wow and flutter... \*0.008% WRMS - [FG method]  
0.023% WRMS (JIS) } - [Record method]  
±0.030% WTD Peak (DIN) }  
\* The FG method entails measurement of wow and flutter from the platter's rotational frequency.  
S/N ..... 85 dB (DIN-B)  
Platter ... 360 mm diameter aluminum diecast  
Motor characteristics  
Activation ..... Below 1 revolution  
Deviation in rotation ..... Below 0.002%  
Drift ..... Time 0.00008%/h  
Temperature : 0.00003%/°C

**Tonearm**  
Type ..... Static balance replaceable pipe type  
Accessory straight arm pipe with integrated head shell  
Effective length ..... 282 mm  
Overhang ..... 13.5 mm  
Compatible cartridge dead weight .....  
For straight arm use, 2.4 - 12 g  
Height adjustment range ..... + 6 mm, - 4 mm

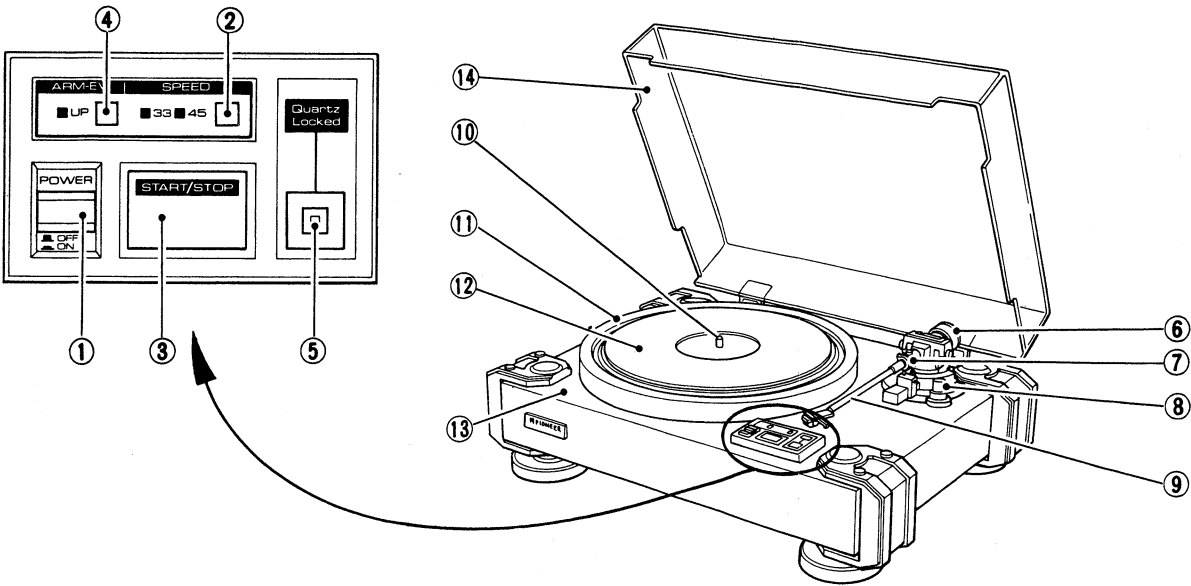
**Accessories**  
DRA (Dynamic Resonance Absorber)  
Auto-up mechanism  
Quick stop mechanism  
Anti-skating mechanism  
Arm elevation mechanism  
Direct reading tracking force weight

**Power, other items**  
Power supply ..... AC120V, 60Hz  
Power consumption ..... 14 W  
External dimensions ..... 596(W) x 215(H) x 434(D) mm  
23-7/16(W) x 8-7/16(H) x 17-1/16(D) in  
Net weight ..... 17.3 kg (38 lb 2 oz)

**Accessory equipment**  
EP adaptor ..... 1  
Overhang gauge ..... 1  
Cartridge mounting screws ..... 8  
Cartridge mounting washers ..... 2  
Cartridge mounting nuts ..... 2  
Weight plate ..... 1  
Operating instructions ..... 1

NOTE:  
Specifications and design subject to possible modification without notice, due to improvements.

3. FRONT PANEL FACILITIES



- ① **POWER switch**  
Press this switch to turn the power on and off.  
[ON] (depressed position) : Power is switched ON.  
[OFF] (raised position) : Power is switched OFF.

② **SPEED switch**  
Set this switch in accordance with the speed of the record to be played. The indicator lamp for the selected speed will light up.  
The [33] indicator lamp is lit for records to be played at a speed of 33-1/3 rpm.  
The [45] indicator lamp is lit for records to be played at 45 rpm.

③ **START/STOP switch**  
Press this switch to turn ON/OFF the motor power.  
When the switch is pressed, motor power is ON and the platter begins to rotate (START).  
If the switch is pressed while the platter is revolving, the brake is operated and the platter stops (STOP).

④ **ARM ELEVATION switch (ARM EV)**  
• Use this switch to raise the arm when the platter is revolving.  
• Use the switch to stop record play.  
• Use the switch when changing a record track during play.  
[UP] indicator lamp ON : Tonearm is raised. (stylus is removed from record)  
[UP] indicator lamp OFF : Tonearm is lowered. (stylus contacts the record)
- ⑤ **QUARTZ LOCKED indicator**  
This indicator lamp is lit when the record is revolving exactly at either 33-1/3 rpm or 45 rpm.

⑥ **Balance Weight**  
This is used when making stylus tracking force adjustments.

⑦ **Arm rest**  
Use the arm rest to support or secure the tonearm.

⑧ **Anti-skating adjuster knob**  
Turn this knob to adjust the amount of anti-skating.

⑨ **Tonearm**

⑩ **Platter shaft**

⑪ **Platter**

⑫ **Rubber mat**

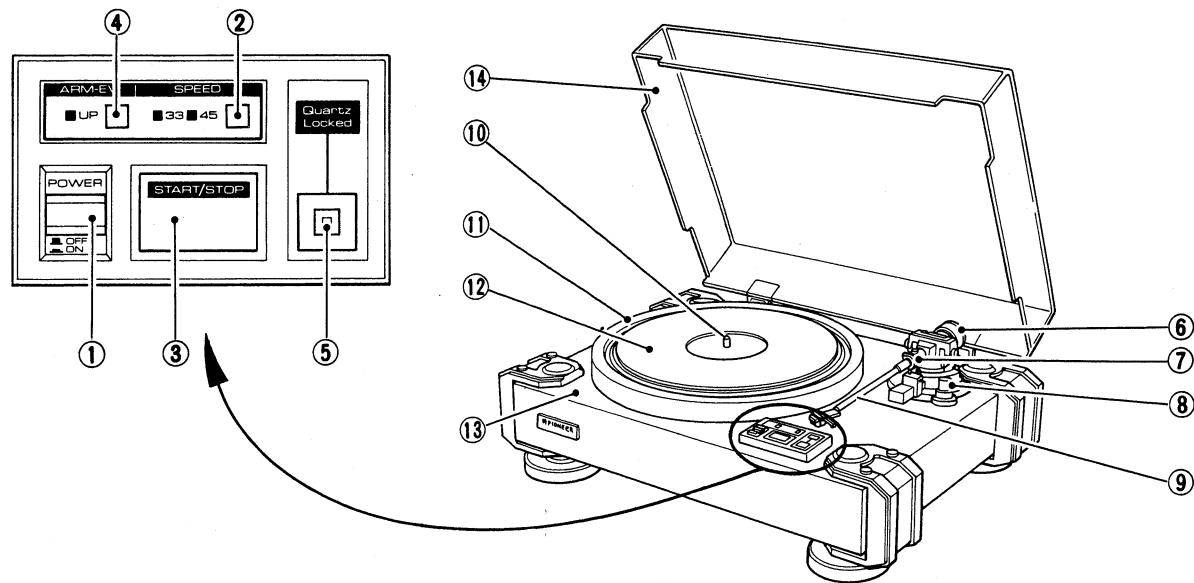
⑬ **Cabinet**

⑭ **Dust cover**

4. PAC

Parts List	
Mark	No.
	1.
	2.
	3.
	4.
	5.
	6.
	7.
	8.
	9.
	10.

3. FRONT PANEL FACILITIES



① POWER switch

Press this switch to turn the power on and off.  
[ON] (depressed position) : Power is switched ON.  
[OFF] (raised position) : Power is switched OFF.

② SPEED switch

Set this switch in accordance with the speed of the record to be played. The indicator lamp for the selected speed will light up.  
The [33] indicator lamp is lit for records to be played at a speed of 33-1/3 rpm.  
The [45] indicator lamp is lit for records to be played at 45 rpm.

③ START/STOP switch

Press this switch to turn ON/OFF the motor power.  
When the switch is pressed, motor power is ON and the platter begins to rotate (START).  
If the switch is pressed while the platter is revolving, the brake is operated and the platter stops (STOP).

④ ARM ELEVATION switch (ARM EV)

- Use this switch to raise the arm when the platter is revolving.
- Use the switch to stop record play.
- Use the switch when changing a record track during play.

[UP] indicator lamp ON : Tonearm is raised. (stylus is removed from record)  
[UP] indicator lamp OFF : Tonearm is lowered. (stylus contacts the record)

⑤ QUARTZ LOCKED indicator

This indicator lamp is lit when the record is revolving exactly at either 33-1/3 rpm or 45 rpm.

⑥ Balance Weight

This is used when making stylus tracking force adjustments.

⑦ Arm rest

Use the arm rest to support or secure the tonearm.

⑧ Anti-skating adjuster knob

Turn this knob to adjust the amount of anti-skating.

⑨ Tonearm

⑩ Platter shaft

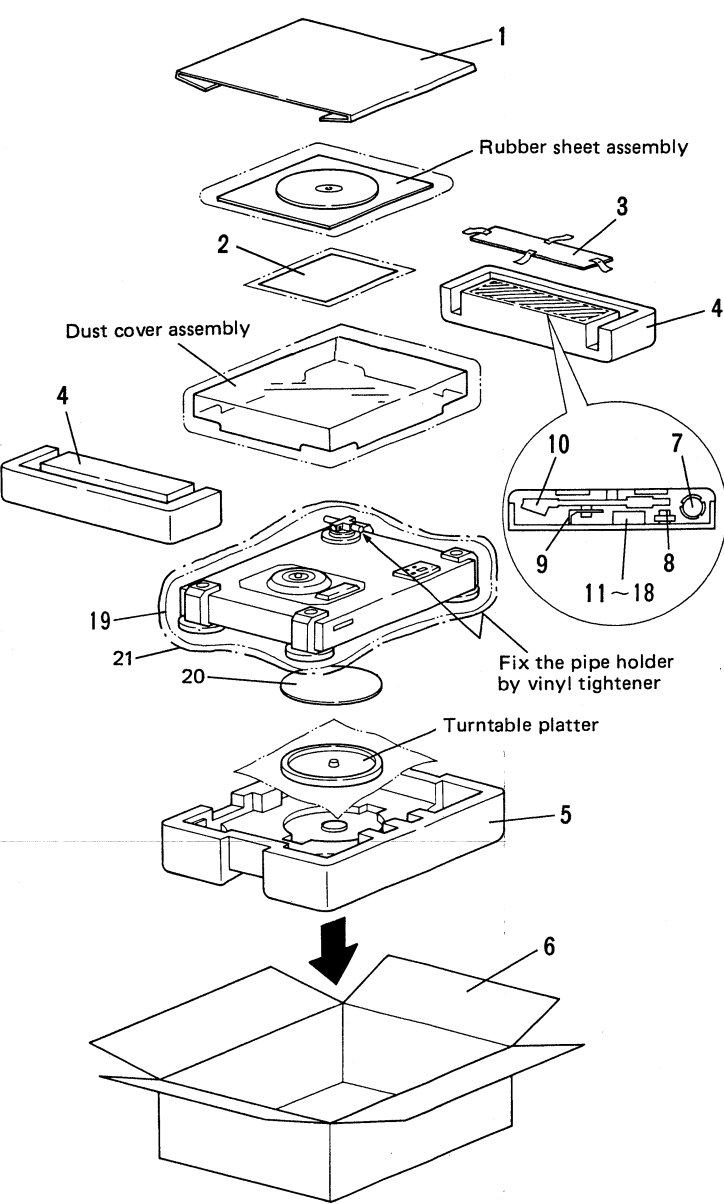
⑪ Platter

⑫ Rubber mat

⑬ Cabinet

⑭ Dust cover

4. PACKING



Parts List of Packing

Mark	No.	Part No.	Description	Mark	No.	Part No.	Description
	1.	PHC-070	Upper pad	11.	PBA-532	Screw	
	2.	PRE1036	Operating instructions (English/French)	12.	PBA-536	Screw	
	3.	PHC1013	Accessory parts lid	13.	.....	.....	
	4.	PHA-185	Hood protector	14.	PBN-902	Nut	
	5.	PHA-184	Protector	15.	B23-642	Washer	
	6.	PHG1135	Packing case	16.	PBA-905	Screw	
	7.	PXA1085	Weight assembly	17.	PBA-508	Screw	
	8.	N93-603	45 adaptor	18.	N64-698	Weight	
	9.	PEC-012	Overhang gauge	19.	Z23-020	Mirror mat	
	10.	PXA1083	Straight pipe assembly	20.	PHC-102	Spacer	
				21.	PHL-026	Cover	

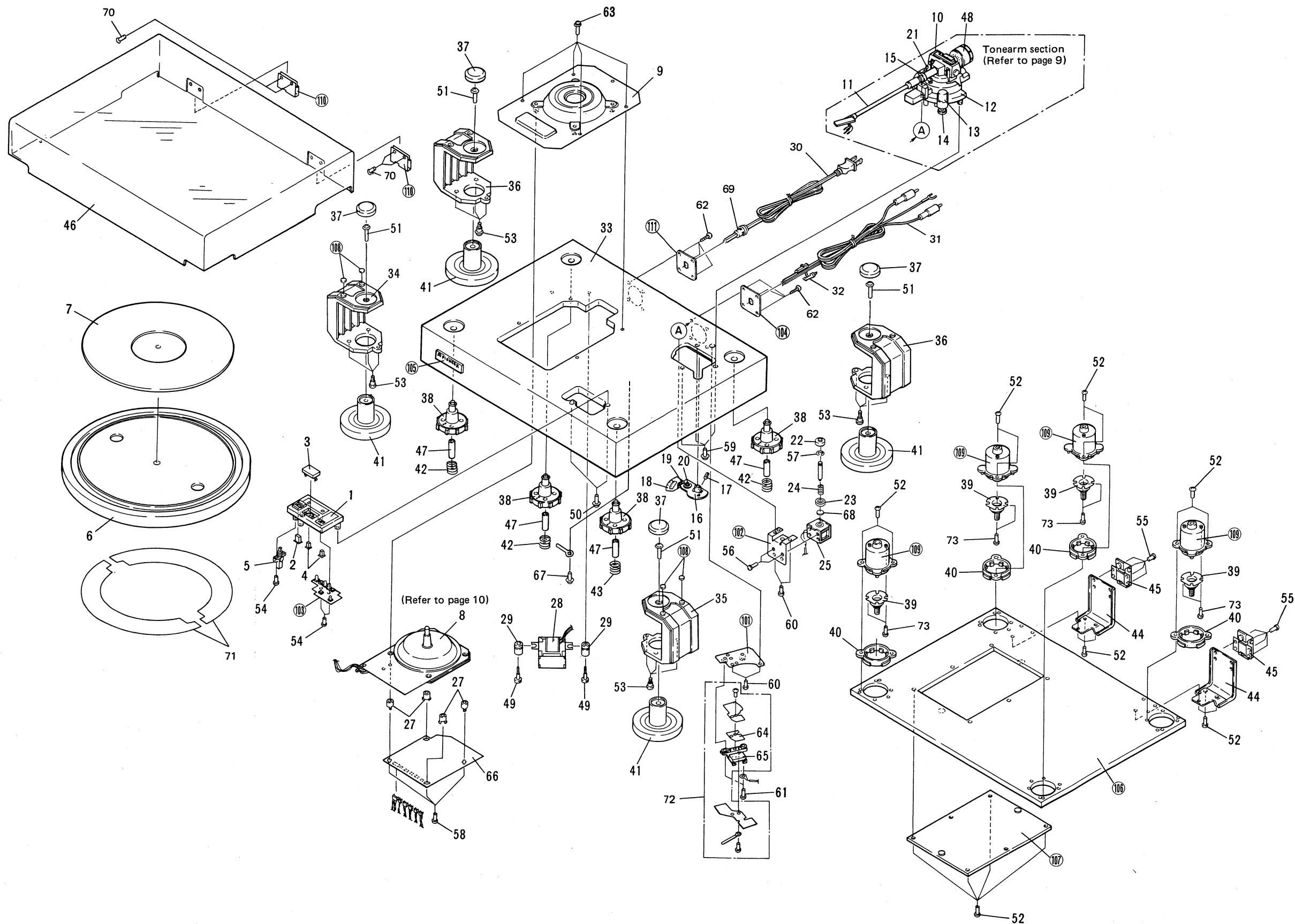


## 5. EXPLODED VIEWS

## 5.1 EXTERIOR

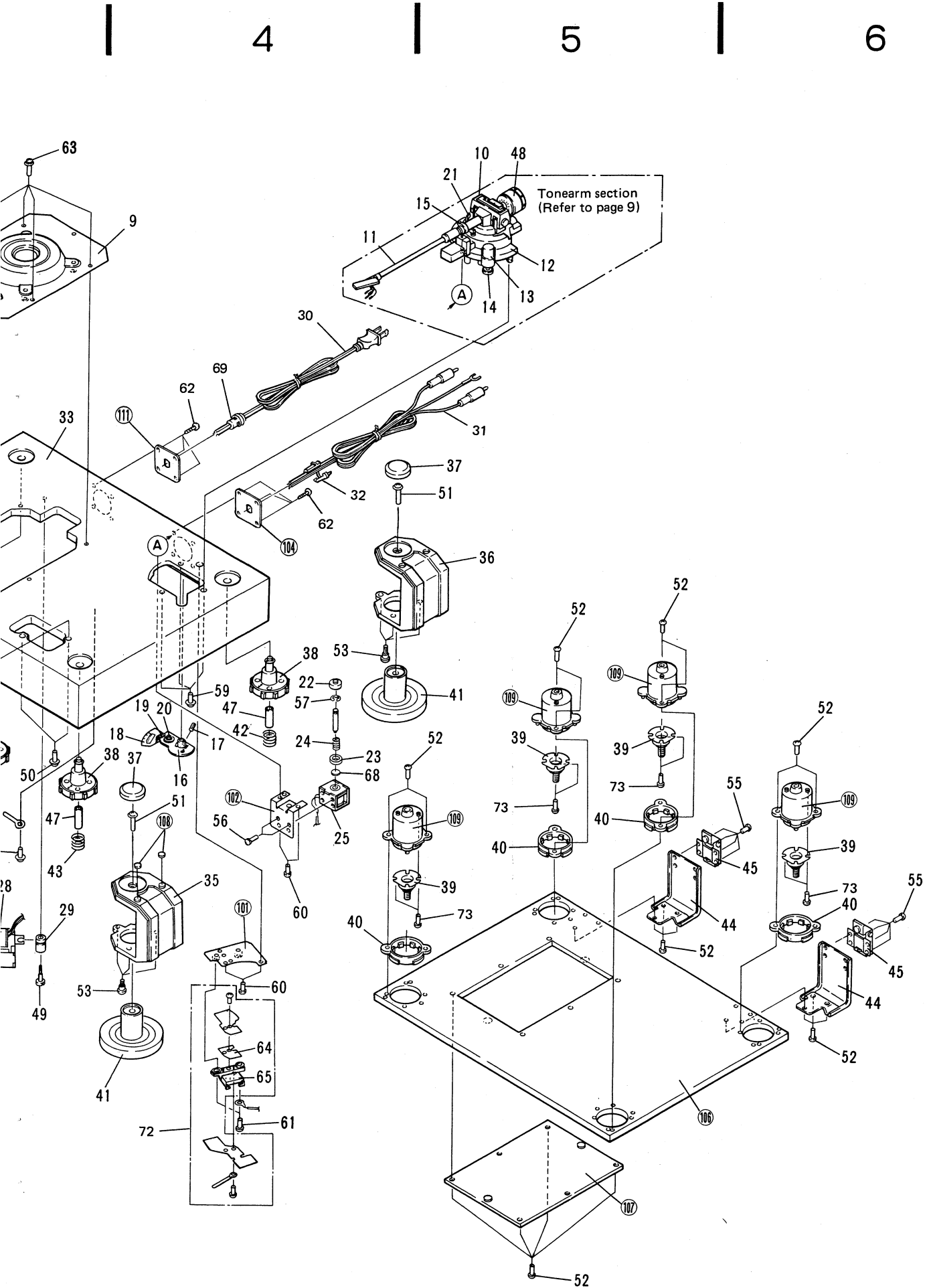
## NOTES:

- Parts without
- The  $\Delta$  mark factor of the
- tion.
- For your pa and  $\star$ .
- $\star\star$  GENE
- This classifi
- number, ten
- Parts marke
- than usual c



## Parts List of

Mark	No.
	1.
	2.
	3.
	4.
$\Delta$ $\star\star$	5.
	6.
$\Delta$	7.
	8.
	9.
$\star$	10.
	11.
	12.
	13.
	14.
$\star\star$	15.
	16.
	17.
	18.
	19.
	20.
	21.
	22.
	23.
	24.
$\star$	25.
	26.
$\Delta$ $\star$	27.
$\Delta$	28.
	29.
	30.
	31.
	32.
	33.
	34.
	35.
	36.
	37.
	38.
	39.
	40.
	41.
	42.
	43.
	44.
$\star$	45.



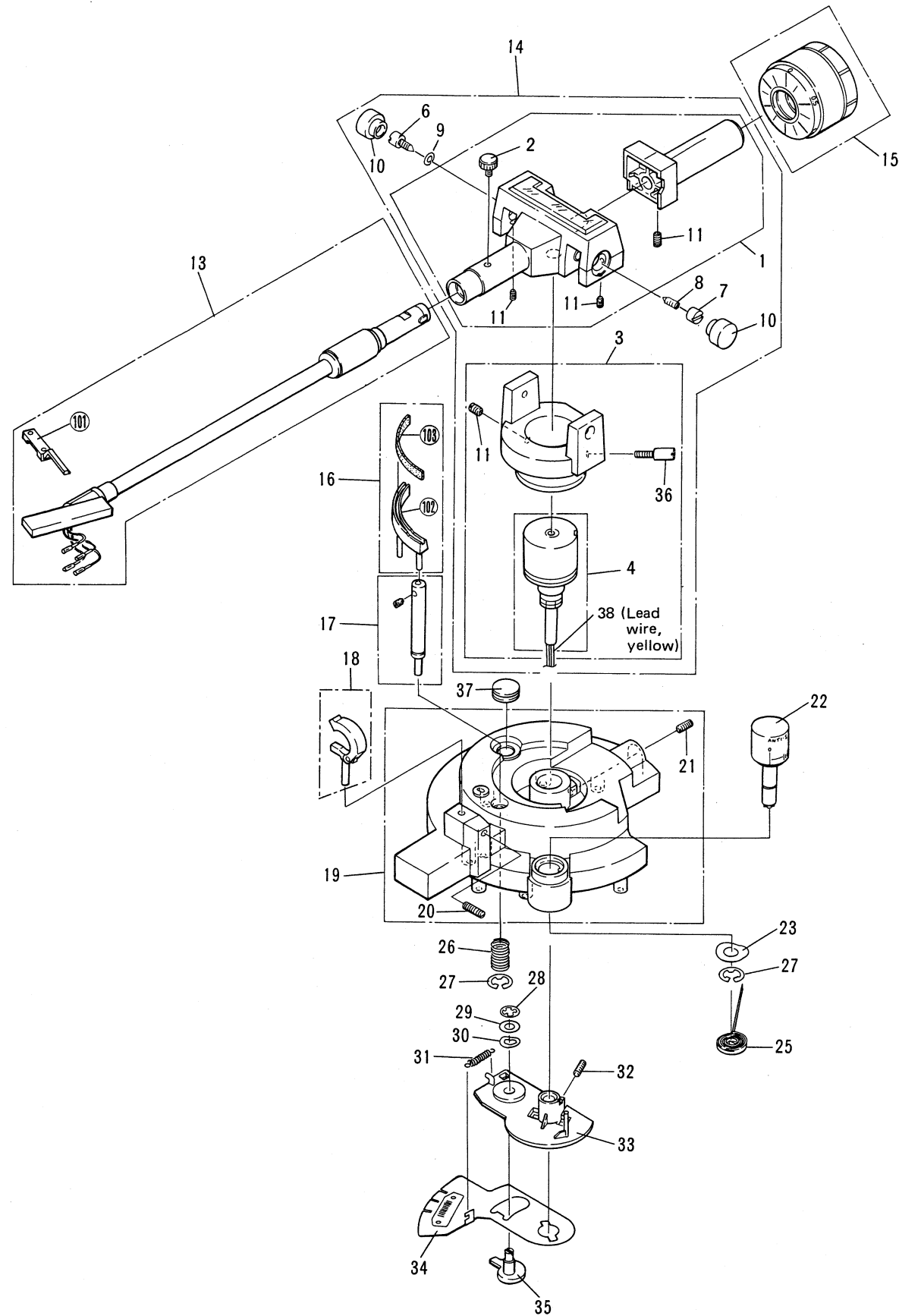
NOTES:

- Parts without part number cannot be supplied.
- The  $\Delta$  mark found on some component parts indicates the importance of the safety factor of the part. Therefore, when replacing, be sure to use parts of identical designation.
- For your parts Stock Control, the fast moving items are indicated with the marks  $\star\star$  and  $\star$ .  
 $\star\star$  **GENERALLY MOVES FASTER THAN  $\star$**   
 This classification shall be adjusted by each distributor because it depends on model number, temperature, humidity, etc.
- Parts marked by "●" are not always kept in stock. Their delivery time may be longer than usual or they may be unavailable.

Parts List of Exterior

Mark	No.	Part No.	Description	Mark	No.	Part No.	Description
	1.	PXT1015	Control panel unit	$\star\star$	46.	PXA1084	Dust cover assembly
	2.	PNY-250	Push button (P)		47.	PNC-345	Spacer
	3.	PAD1031	Button unit (S)		48.	PXA1085	Weight assembly
	4.	PNY-253	Push button (Q)		49.	PBA-166	Screw
$\Delta$ $\star\star$	5.	PSA1001	Power switch		50.	PBA-159	Screw
	6.	PYY1040	Turntable platter assembly		51.	PBZ40P450FMC	Screw
$\Delta$	7.	PEA1001	Turntable sheet assembly		52.	PBA-165	Screw
	8.	PXM-131	Motor assembly		53.	PBA-177	Screw
$\star$	9.	PXV-080	Motor cover unit		54.	PPC30P080FMC	Screw
	10.	PPD1014	Tonearm assembly		55.	PSZ30P060FZK	Screw
	11.	PXA1083	Straight pipe assembly		56.	PMA30P060FMC	Screw
	12.	PNR1019	Tonearm base		57.	YE70S	E ring
	13.	PXV-081	AS button unit		58.	PMA40P160FMC	Screw
$\star\star$	14.	PBH-403	Spring		59.	PMB50P160FMC	Screw
	15.	PXB-507	Tonearm rest assembly		60.	PAZ30P080FMC	Screw
	16.	PNY-127	PU plate		61.	PDZ30P080FMC	Screw
	17.	ZMD40H140FBT	Screw		62.	PYC30P080FZK	Screw
	18.	PXT-430	Shutter unit		63.	PMB30P200FZK	Screw
	19.	PBH-364	PU plate spring		64.	PNC-183	Optical acceptor slit
	20.	PNW-592	Adjustment cam		65.	PNX-189	Spacer
	21.	PXB-210	EV sheet assembly	$\Delta$ ●	66.	PWZ1343	Control P.C. board unit
	22.	PEB-272	Cushion rubber		67.	PYC30P120FZK	Screw
	23.	PED-033	Buffer		68.	PED-037	Washer
	24.	PBH-405	UP spring		69.	CM-22C	Strain releaf (For power cord)
$\star$	25.	PXB-424	Solenoid assembly		70.	CMK40P100FBR	Screw
	26.	.....	.....		71.	PNM1021	Damper T
$\Delta$ $\star$	27.	PNW1288	Stopper collar	●	72.	PWX-089	Sensor P.C. board assembly
	28.	PTT1030	Power transformer (AC 120V)		73.	PPZ30P120FMC	Screw
$\Delta$	29.	PEB-250	Transformer base rubber		101.		Sensor base unit (A)
	30.	PDG1002	Power cord KU/KC		102.		Solenoid fixed angle
	31.	PDE1025	PU cord		103.		Control board unit
	32.	PEC-049	Strain relief (For PU cord)		104.		Fixer (A)
	33.	PMM1007	Cabinet		105.		Name plate
	34.	PNW1269	Insulator angle L		106.		Bottom plate unit
	35.	PNW1270	Insulator angle R		107.		Under panel
	36.	PNY-244	Insulator angle B		108.		Hood rubber
	37.	PNW1271	Insulator cap		109.		Under case
	38.	PEB-274	Insulator damper		110.		Lock plate
	39.	PXV-085	Insulator unit		111.		Fixer (B)
	40.	PEB-276	Lateral damper				
	41.	PNY-245	Insulator case				
	42.	PBH-407	Insulator spring (A)				
	43.	PBH-408	Insulator spring (B)				
	44.	PNC-344	Dust cover angle				
$\star$	45.	PXB-417	Spring hinge				

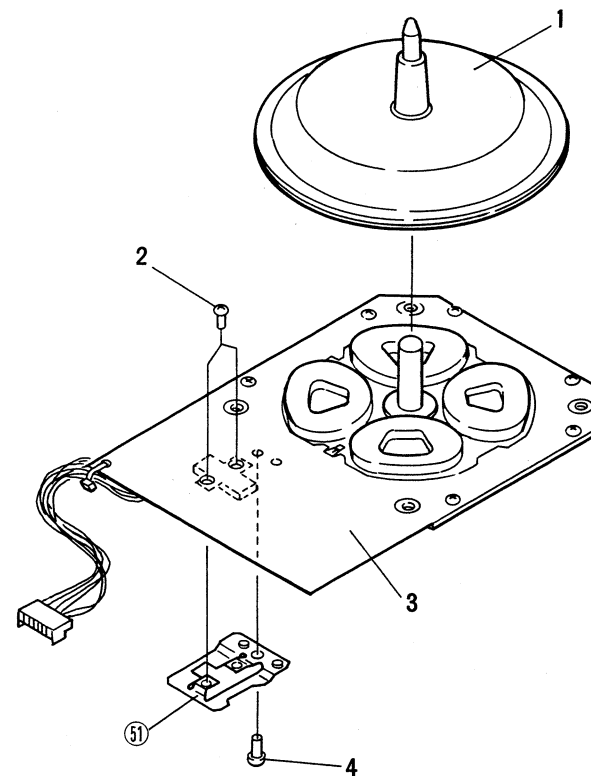
5.2 TONEARM SECTION



Parts List of Tonearm Section

Mark	No.	Part No.	Description	Mark	No.	Part No.	Description
	1.	PXA1081	Pipe holder assembly		21.	ZMK40H080FBT	Screw
	2.	PLB-754	Screw		22.	PXV-081	AS button unit
	3.	PXA1082	Outer holder assembly		23.	PBE-012	AS spring washer
	4.	PXB-609	Guide ring assembly		24.	.....	.....
	5.	.....	.....		25.	PBH-403	Spring
	6.	PLB-727	Screw		26.	PBH-404	EV spring
	7.	PLB-718	Nut		27.	YE50S	E ring
	8.	PLA-580	Pivot		28.	YS40S	Stopper ring
	9.	WS30FMC	Washer		29.	WC40FMC	Washer
	10.	PLC-545	Nut		30.	PBE-019	PU spring washer
	11.	ZMD30H040FBT	Screw		31.	PBH-364	PU plate spring
	12.	.....	.....		32.	ZMD40H140FBT	Screw
	13.	PXA1083	Straight pipe assembly		33.	PNY-127	PU plate
	14.	PPD1014	Tonearm assembly		34.	PXT-430	Shutter unit
	15.	PXA1085	Weight assembly		35.	PNW-592	Adjustment cam
	16.	PXB-210	EV sheet assembly		36.	PLB-839	Screw
	17.	PLB-207	EV shaft		37.	PEB-192	Rubber bush
	18.	PXB-507	Tonearm rest assembly		38.	PDF-514	GND lug unit
	19.	PNR1019	Tonearm base				
	20.	ZMK30M120FNI	Screw		101.		Headshell
				102.		EV sheet unit	
				103.		EV sheet	

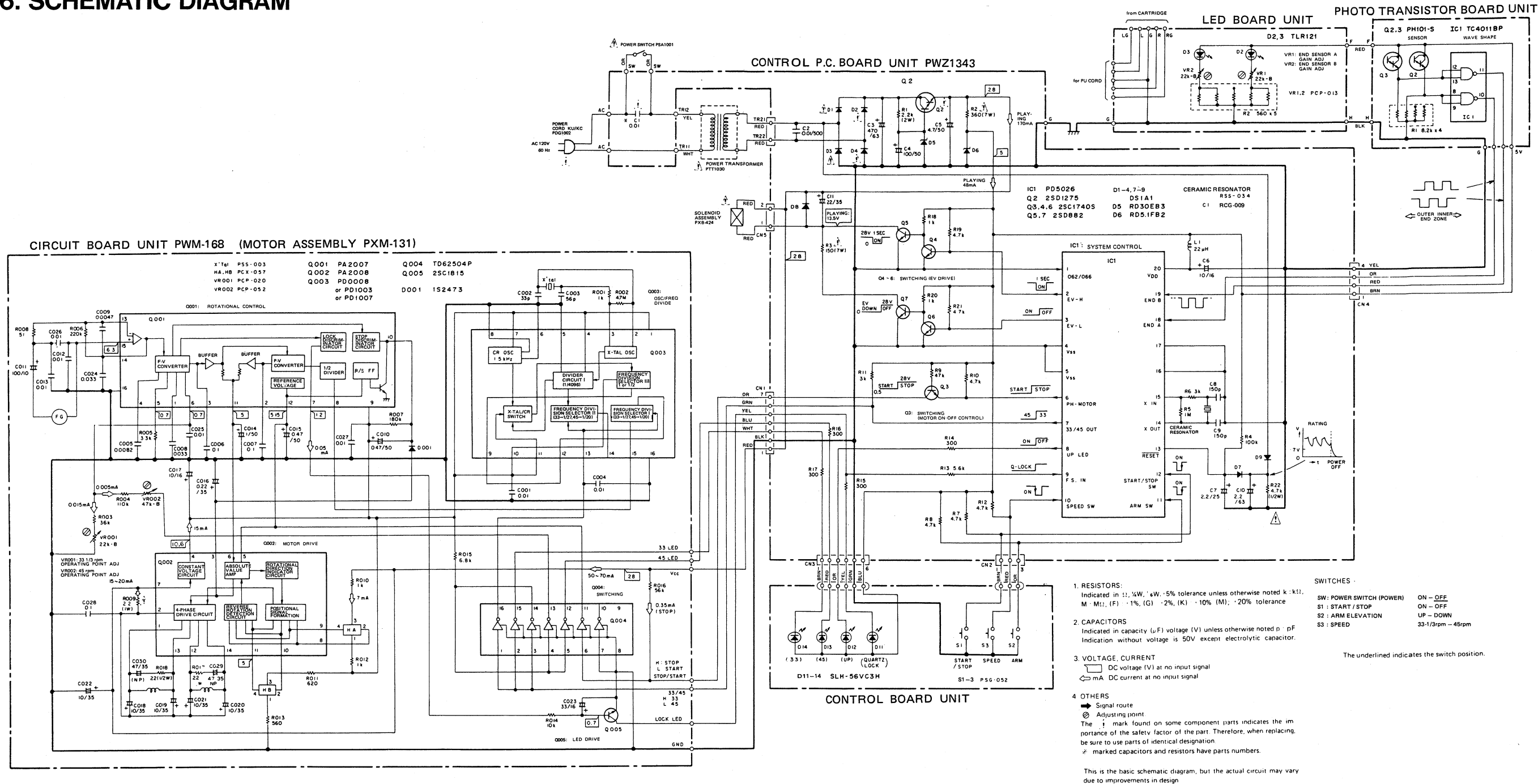
5.3 MOTOR ASSEMBLY (PXM-131)



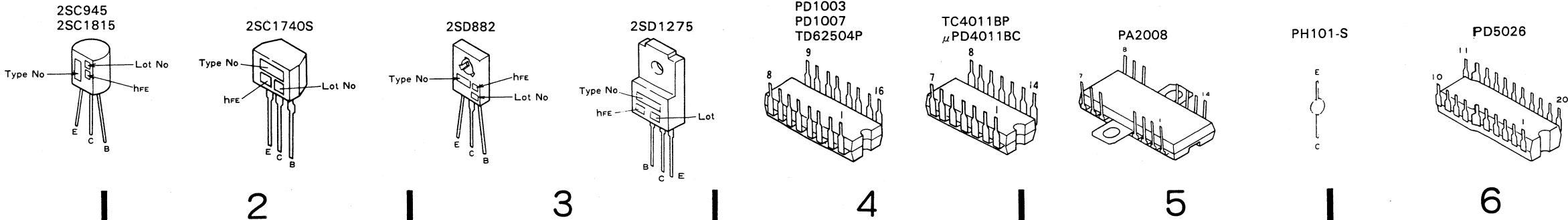
Parts List of Motor Assembly

Mark	No.	Part No.	Description
A	1.	PXV-053	Rotor unit
	2.	PCZ30P050FMC	Screw
	3.	PWM-168	Circuit board unit
	4.	PCZ40P080FMC	Screw
	51.		Heat sink

6. SCHEMATIC DIAGRAM

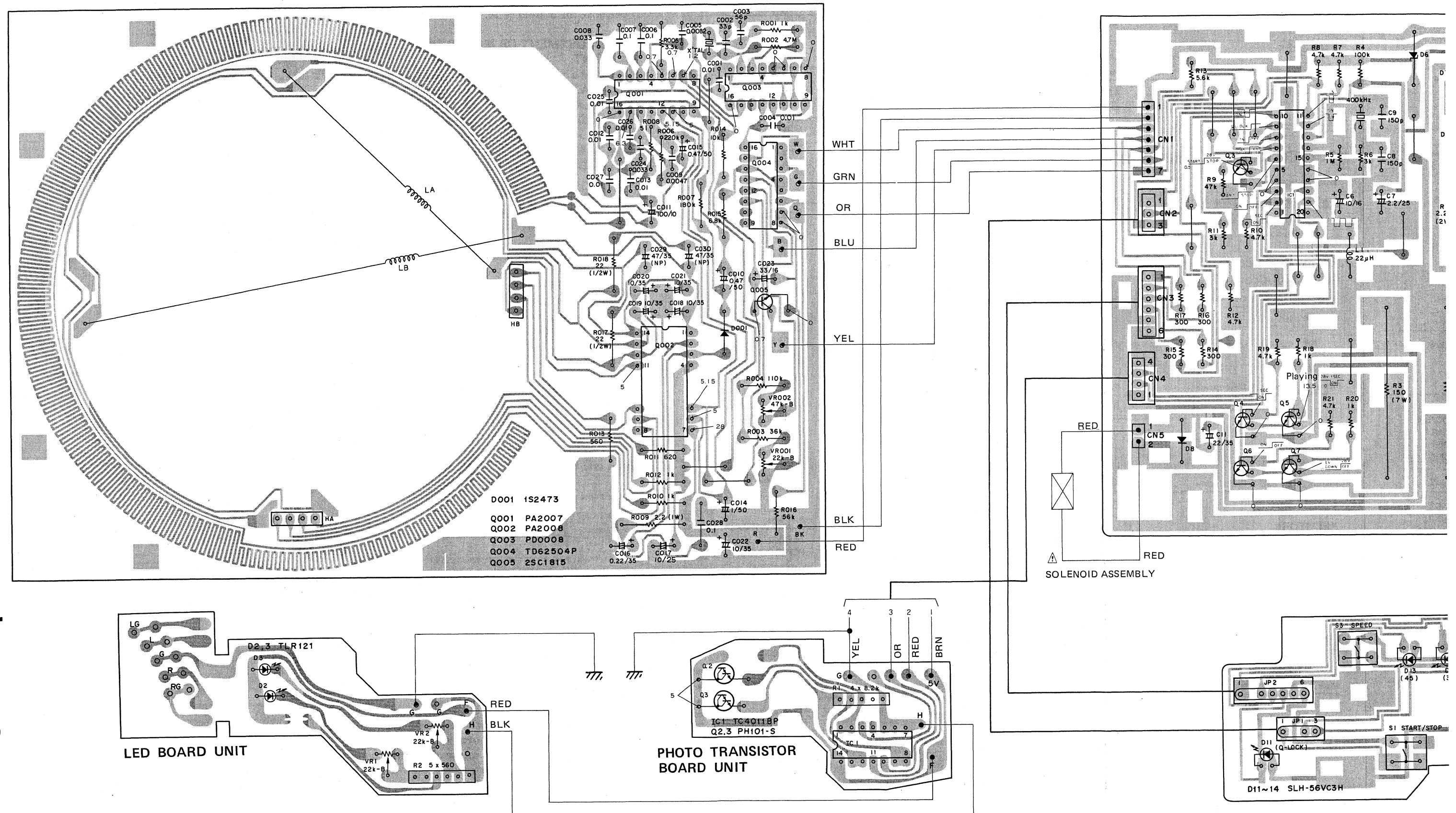


External Appearance of Transistors and ICs



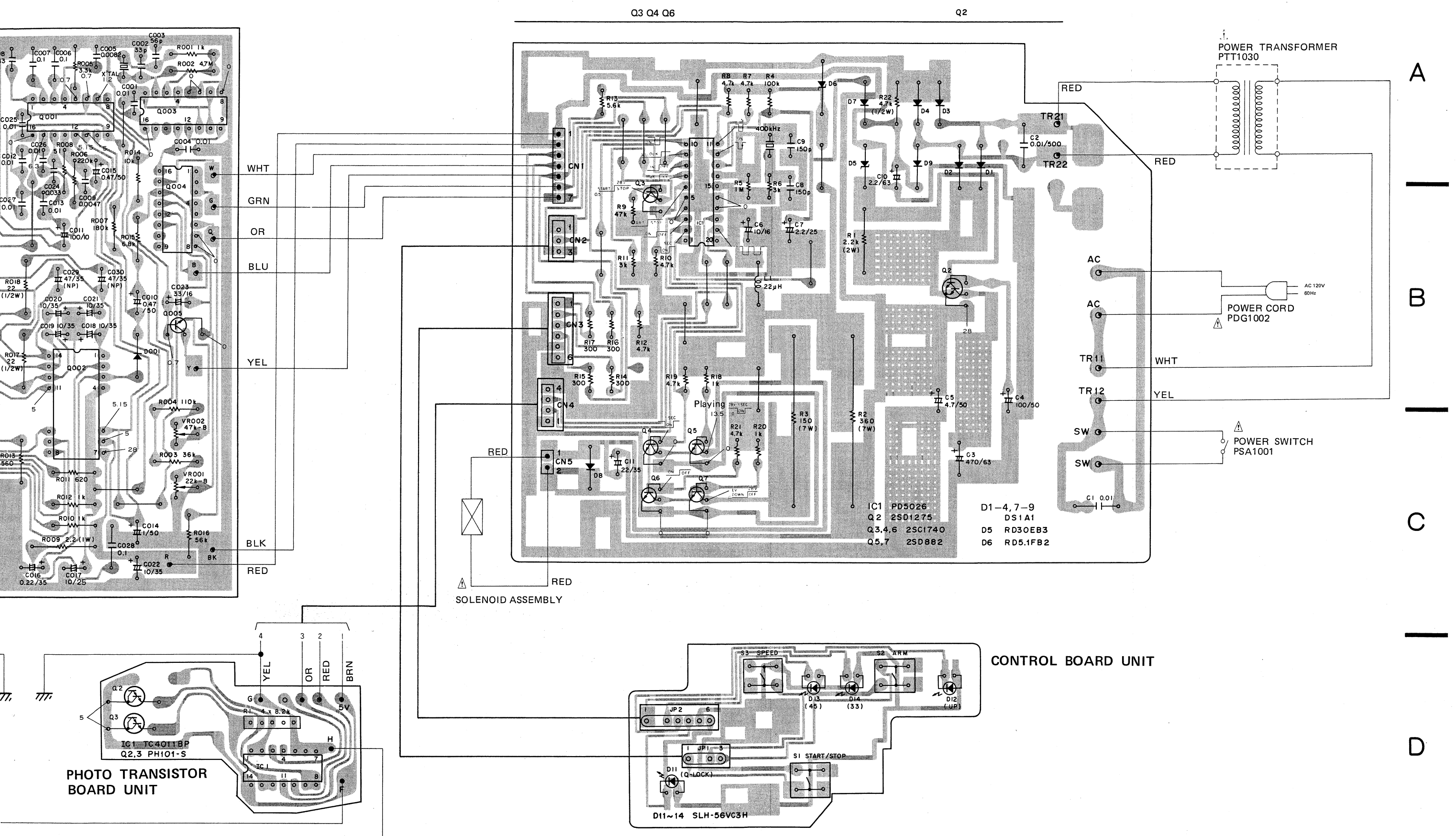
**MOTOR ASSEMBLY (PXM-131) · CIRCUIT BOARD UNIT (PWM-168)**

Q3 Q4 Q6





## CONTROL P.C. BOARD UNIT (PWZ1343)





## Control Board Unit SEMICONDUCTORS

Mark	Symbol & Description	Part No.
★	D11 – D14	SLH-56VC3H

## SWITCHES

Mark	Symbol & Description	Part No.
★★	S1 – S3 Tact switch (START/STOP, SPEED, ARM)	PSG-052

## Circuit Board Unit (PWM-168) SEMICONDUCTORS

Mark	Symbol & Description	Part No.
★★	Q001	PA2007
★★	Q002	PA2008
★★	Q003	PD0008 (PD1003) (PD1007)
★★	Q004	TD62504P
★★	Q005	2SC1815 (2SC945)
★	D001	1S2473

## CAPACITORS

Mark	Symbol & Description	Part No.
	C005	CQMA822K50
	C024	CQMA333K50
	C006, C007	CQMA104K50
	C002	CCDCH330J50
	C003	CCDCH560J50
	C009	CKDYF472Z50
	C001, C012, C013, C025 – C027, C004	CKDYF103Z50
	C028	CKDYF104Z50
	C008	CQPA333J50
	C010, C015	CEAR47M50L
	C017	CEA100M25L
	C018 – C022	CEA100M35L
	C023	CEA330M16L
	C011	CEA101M10L
	C014	CEA010M50L
	C029, C030	CEANP470M35
	C016	CSZAR22M35 (CSYAR22M50)

## RESISTORS

Mark	Symbol & Description	Part No.
★	VR001 Semi-fixed (22kΩ-B)	PCP-020
★	VR002 Semi-fixed (47kΩ-B)	PCP-052
	R003	RN1/4PR363F (RN1/4PR3572F) (RN1/4PR3652F)
	R009	RS1PF2R2J
	R017, R018	RD1/2PS220J
	Other resistors	RD1/4PM□□□J

## OTHERS

Mark	Symbol & Description	Part No.
	X'tal Crystal resonator	PSS-003
	HA, HB Hall element	PCX-057
	Connector assembly	PDE-289
	Screw	PCZ30P050FMC
	Screw	PCZ40P080FMC

## MOTOR ASSEMBLY (PXM-131)

## P.C. Board Assemblies

Mark	Symbol & Description	Part No.
	Rotor unit	PXV-053
	Circuit board unit	PWM-168

# 9. ADJUSTMENTS

Remove the bottom plate.

## 9.1 ADJUSTMENT OF MOTOR OPERATING POINT

1. Connect a buffer amplifier to pin ① of the circuit board unit PA2007 (Fig. 9-1) and connect the output to an oscilloscope.
2. Set up the turntable, mount the platter and turn on the power switch.
3. Set the rotation speed switch to 33-1/3 RPM. Press the START/STOP switch to start the motor.
4. When a waveform like that shown in Fig. 9-2 appears on the oscilloscope, adjust the oscilloscope gain so that the peaks agree with 5 Div. Then adjust VR001 so that a:b = 2.8:2.2. (Keep in mind that spurious noise is easily generated.)
5. After making adjustments at 33-1/3 RPM, switch to 45 RPM and repeat the steps in step 4 above substituting VR002 for VR001.
6. Connect an oscilloscope (or a frequency counter) to pin ⑦ of PA2007 and confirm that output is 111Hz at 33-1/3 RPM and 150Hz at 45 RPM.

## 9.2 ADJUSTING SENSITIVITY OF THE RECORD END SENSOR

- Take care that the sensor circuit board is not exposed to external light when making adjustments.
- Attach a dual trace oscilloscope to pins ⑮ and ⑰ of IC1 (PD5026).

## End A and End B Sensor Adjustments

Adjustment	Waveform Test Point	(Color of Lead Wire)	Level Adjustment
end A sensor	IC1 pin ⑮	(orange)	VR1
end B sensor	IC1 pin ⑰	(red)	VR2

1. With the tonearm at the approximate position of the first inner lead-in grooves, slowly (about at the same speed as full auto lead-in) move the arm towards the center spindle. Adjust VR1 and VR2 so that the oscilloscope waveform becomes duty 50% when the arm is moving.

## Confirmation of Phase Difference Between End A and End B

2. After adjusting the sensitivity of the sensors, confirm that the waveform for IC1, pin ⑰ is 90° ± 45° ahead of that for pin ⑮ when the following procedure is performed. With the tonearm at the approximate position of the first inner lead-in grooves, slowly (about at the same speed as full auto lead-in) move the arm towards the center spindle. (When the tonearm is moved outward from the center spindle, the phase angle should be reversed.)
3. At the same time, confirm that Q2 and Q3 as well as D2 and D3 are not bent.

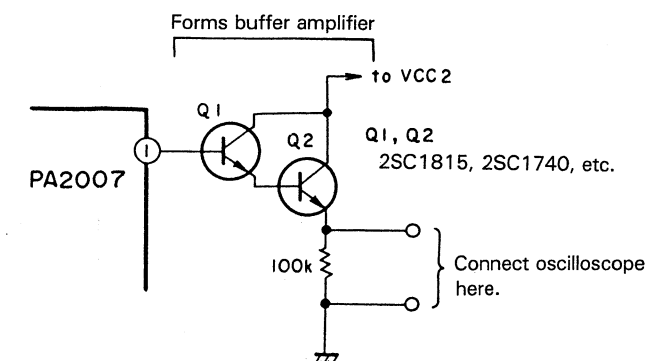


Fig. 9-1 Buffer Amplifier

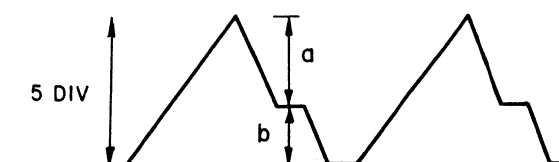


Fig. 9-2 Adjustment Waveform

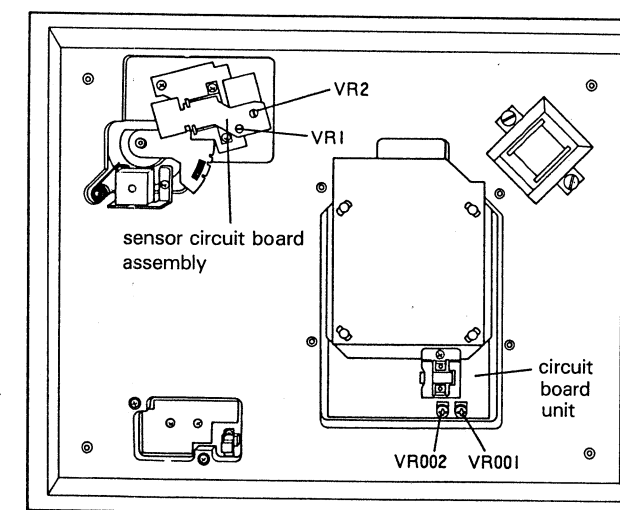


Fig. 9-3 Adjustment Points

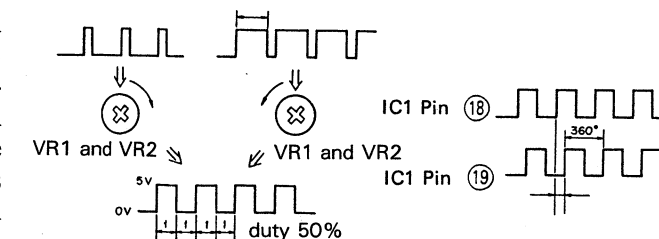


Fig. 9-4 End Sensor Adjustment Waveforms



## 10. CIRCUIT DESCRIPTION

### 10.1 PL-90 BLOCK DIAGRAM

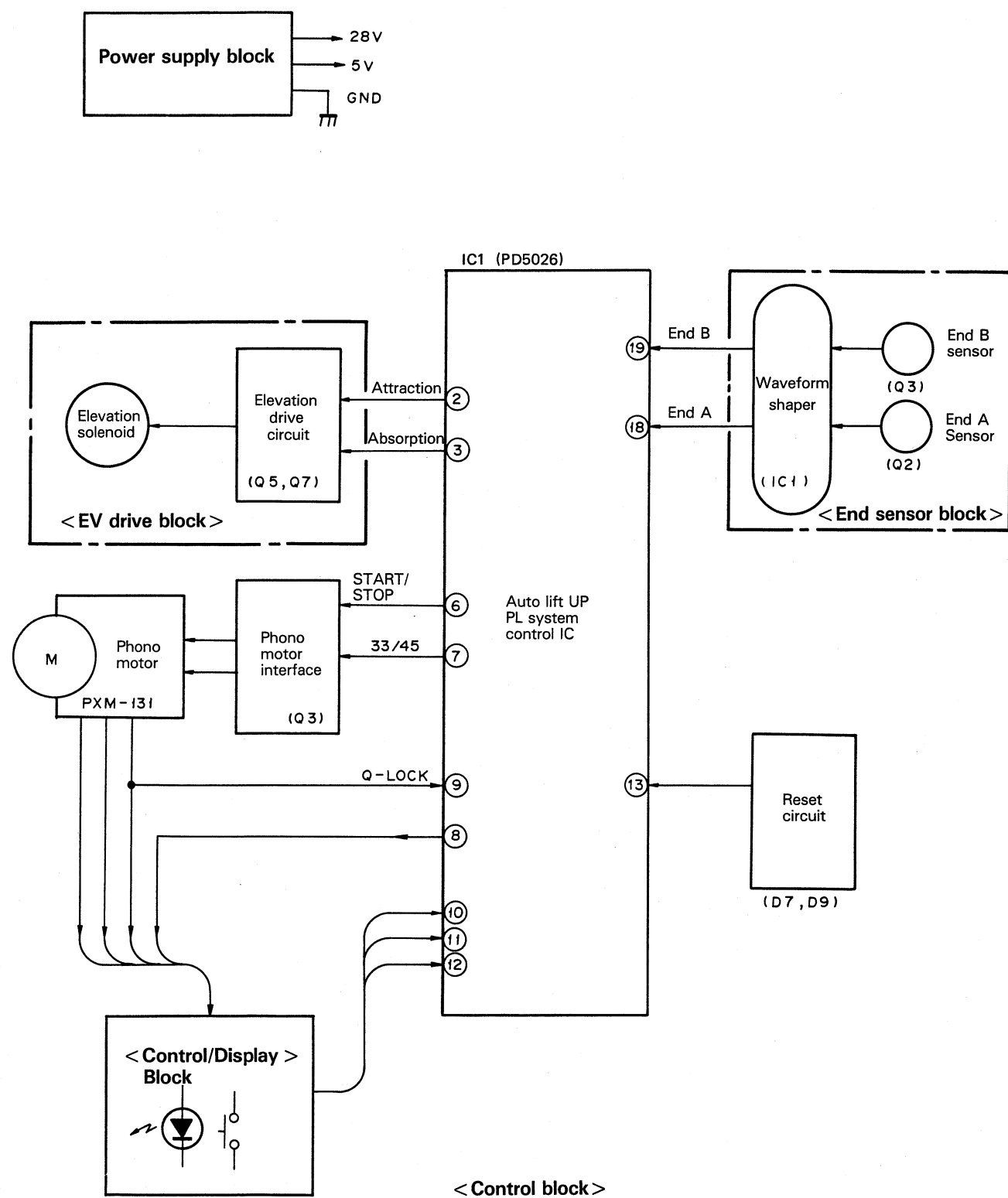


Fig. 10-1 Block Diagram

## 10.2 Timing Chart

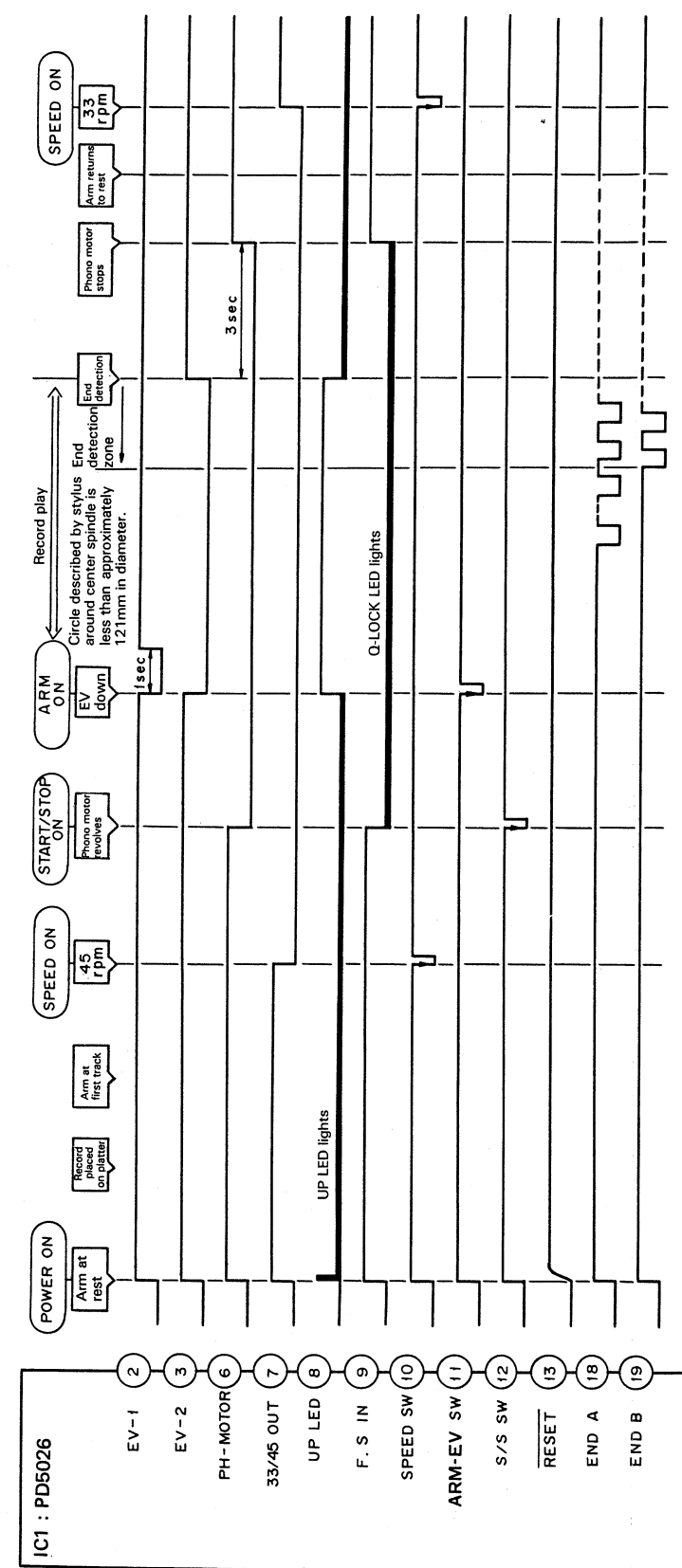


Fig. 10-2 Timing Chart

10.3 PD5026 (Microprocessor) Terminal Functions

PIN NO.	Signal	Input/ Output Display	Terminal Designation	Description of Function	Remarks
1	D <sub>3</sub>	In	O62	PL-90 end detection timer switch input	Arm effective length difference
2	D <sub>4</sub>	Out	EV <sub>1</sub>	Arm elevation output 1 (attraction)	1 second attraction
3	D <sub>5</sub>	Out	EV <sub>2</sub>	Arm elevation output 2 (absorption)	
4	V <sub>SS</sub>	—	—	GND	
5	V <sub>SS</sub>	—	—	GND	
6	D <sub>6</sub>	Out	PH-MOTOR	Phono motor start/stop output	
7	D <sub>7</sub>	Out	33/45 OUT	Phono motor 33/45 switch output	
8	D <sub>8</sub>	Out	UP LED	UP indicator LED output	
9	F <sub>0</sub>	In	F.S. IN	Phono motor fail safe input	⑥: L \ Fail safe at 35 ⑨: H / seconds
10	F <sub>1</sub>	In	SPEED SW	Speed switch input	
11	F <sub>2</sub>	In	ARM-EV SW	Arm elevation switch input	
12	F <sub>3</sub>	In	S/S SW	Phono motor start/stop switch input	
13	Reset	In	—	Initial reset input	
14	XOUT	Out	—	Clock oscillator, external circuit terminal	Ceramic oscillator
15	XIN	In	—	Clock oscillator, external circuit terminal	Ceramic oscillator 400kHz
16	S	—	—		
17	D <sub>0</sub>	—	—		
18	D <sub>1</sub>	In	END A	End (detection) A sensor input	
19	D <sub>2</sub>	In	END B	End (detection) B sensor input	
20	V <sub>DD</sub>	—	—	+ 5V	

NOTE: PD5026 is a C-MOS IC.

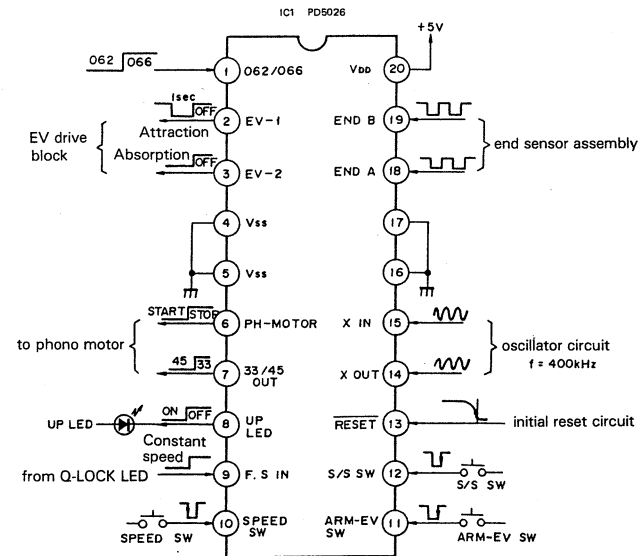


Fig. 10-3 PD5026 Terminal Designations

10.4 Control Block Circuit Description

The control block of the PL-90 uses the PD5026 microprocessor to control operations such as arm auto lift UP and stopping the motor. In addition, a quartz PLL Hall motor is used.

As is shown in the block diagram on page 19, the PL-90 comprises the following sections: the control block, phono motor interface, EV drive block and end sensor assembly.

● Control Block

- The control block comprises the following elements:
  - PD5026: the microprocessor that performs central control functions for all circuit blocks.
  - Oscillator circuit: ceramic oscillator (f = 400kHz).
  - Control/display block: contains all of the turntable's control switches (START/STOP, ARM-EV, SPEED) as well as the indicators which show the turntable's operating condition (33, 45, Q-LOCK, UP LED).
  - Reset circuit (D7, D9): Resets the turntable to its initial condition when power to the PD5026 is turned on or following a drop in voltage.

2. The following chart shows the PD5026's logic settings immediately after initial power turn-on (reset circuit on). (Phono motor off, "UP" LED lit.)

Logic at Power Turn On (tonearm on arm rest)

No.	Logic	No.	Logic
1	L	20	5V
2	H	19	H
3	H	18	H
4	L	17	L
5	L	16	L
6	H	15	—
7	H	14	—
8	L	13	H
9	H	12	H
10	H	11	H

3. After initial power turn-on, operation of the unit can be initiated by any of three control switches (START/STOP, ARM-EV, SPEED switch). Basically, operation is possible using any of these switches independently of the others (the PL-90 is a manual turntable which automatically lifts the stylus at the end of a record). In practice, however, the following limitations apply.

- For approximately 0.5 seconds after the ARM-EV switch is turned on or after the record-end detector initiates arm elevation UP, the ARM-EV switch will not switch to DOWN (in order to protect the solenoid against temperature extremes).
- The phono motor automatically shuts off about three seconds after record-end detection.
- When arm elevation DOWN is initiated by turning the ARM-EV switch on, output from PD5026 pin ② switches to LOW level for one second, attracting the solenoid. Then pin ② switches to HIGH level, and pin ③ maintains a LOW level signal, maintaining solenoid attraction (adsorption).
- If, while the phono motor is operating, rotation of the platter is arrested manually (PD5026, pin ⑨ switches to HIGH level), the tone arm will be raised after approximately 35 seconds and the phono motor will shut off (fail safe).

● Phono Motor Interface

This interface drives the phono motor in response to START/STOP and SPEED switch signals from the PD5026.

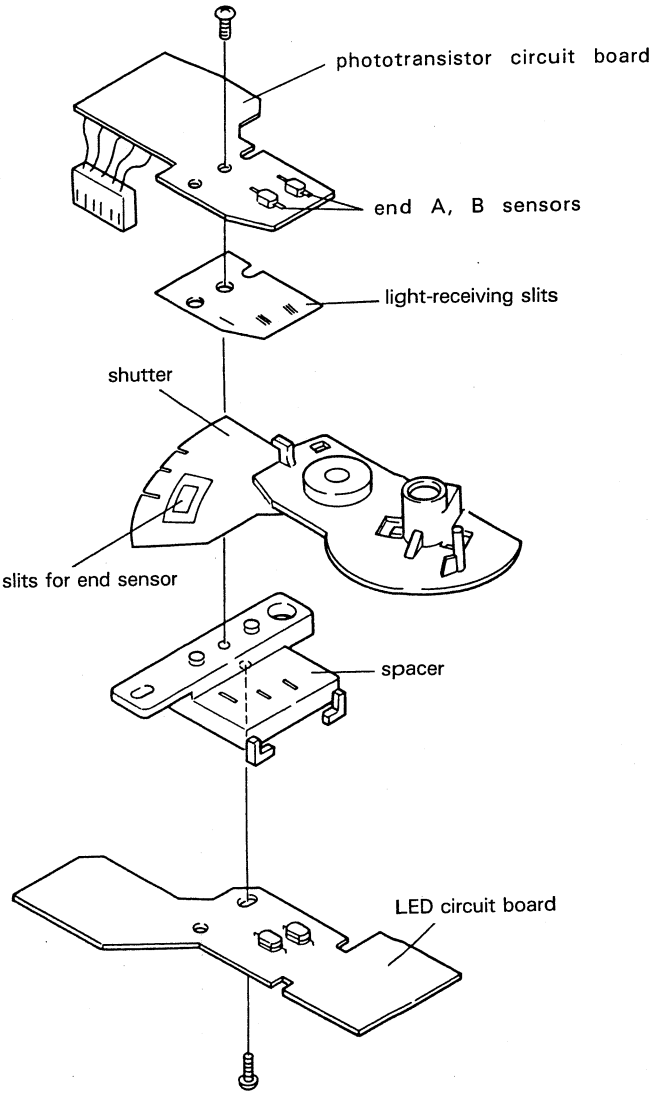


Fig. 10-4 End Sensor Assembly

● EV Drive Block

This circuit block operates the arm elevation solenoid in response to signals from the PD5026.

● End Sensor Assembly

The end sensor assembly consisting of two pairs of LEDs and phototransistors built into the bottom of the tonearm assembly. Slits in the shutter, which is linked to the tonearm, turn the phototransistors on and off as the tonearm moves. A waveform shaper shapes the resulting signals into pulses with a phase angle of approximately 90°. These pulses are then sent to the control block (PD5026) as record end groove detection signals.

### 1 Initiation of motor rotation (Fig. 10-5)

S/S switch (S1) ON

IC1 (12)  ("start motor" signal input)


IC1⑥  → motor rotation begins

motor quartz lock ON → D11 (Q-LOCK) lights

IC1 ⑨  $\rightarrow$  microprocessor (IC1) determines when motor has reached correct rotational speed

## 2 Lowering the tonearm

ARM-EV switch (S2) ON

IC1 (11)  ("lower tonearm" signal input)


→ IC1 ② 1 second  $\square$  → Q4 OFF, Q5 ON 1 second → solenoid on (attraction) → tone arm lowers

→ IC1 ③  $\downarrow$  → Q6 OFF, Q7 ON → solenoid remains ON (absorption)

IC1 (8) → UP LED D12 lights

### 3 End sensor (Fig. 10-6, 10-5)

The tonearm moves toward the center of the record during play. As the stylus approaches the record end grooves, the end sensor slits in the sensor circuit board assembly's shutter block the light from the LEDs.

Q2, Q3 ON/OFF → IC1 (10, 11) output  ... (90° phase angle) → input to IC1 (18, 19) → end point detection—

→ IC1 ③  → Q6.ON, Q7.OFF → solenoid OFF → tonearm rises

→ IC1 (8)  $\overline{Q} \rightarrow$  "UP" LED lights (D12)

after 3 seconds  $\rightarrow$  IC1 ⑥  $\rightarrow$  motor rotation stops

→ Q-LOCK LED extinguishes (D11)

↳ IC1 ⑨    ↗

#### 4 Raising the tonearm

ARM-EV switch (S2) ON.

IC1 (11) 

IC1 ③  → Q6.ON, Q7.OFF → solenoid OFF → tonearm rises

IC1 ⑧  → UP LED D12 lights

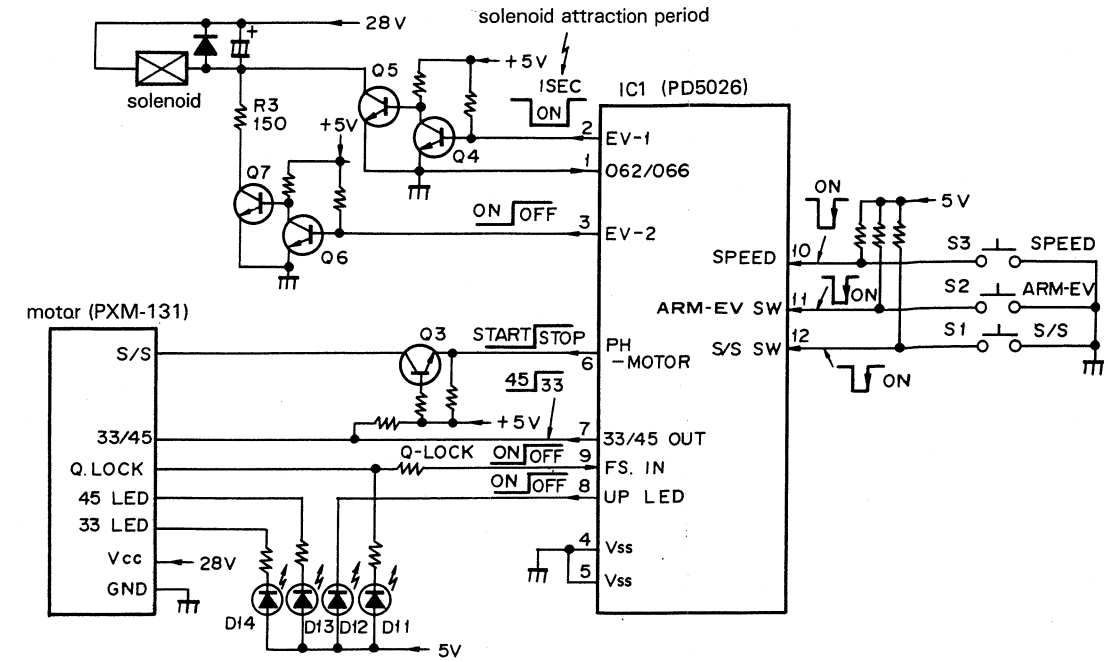
**5 Motor rotation stops**

S/S switch (S1) ON

IC1 (12) 

IC1 ⑥   $\rightarrow$  motor rotation stops

Q-LOCK LED extinguishes (D11)

IC1 ⑨ 

**Fig. 10-5 Control Block**

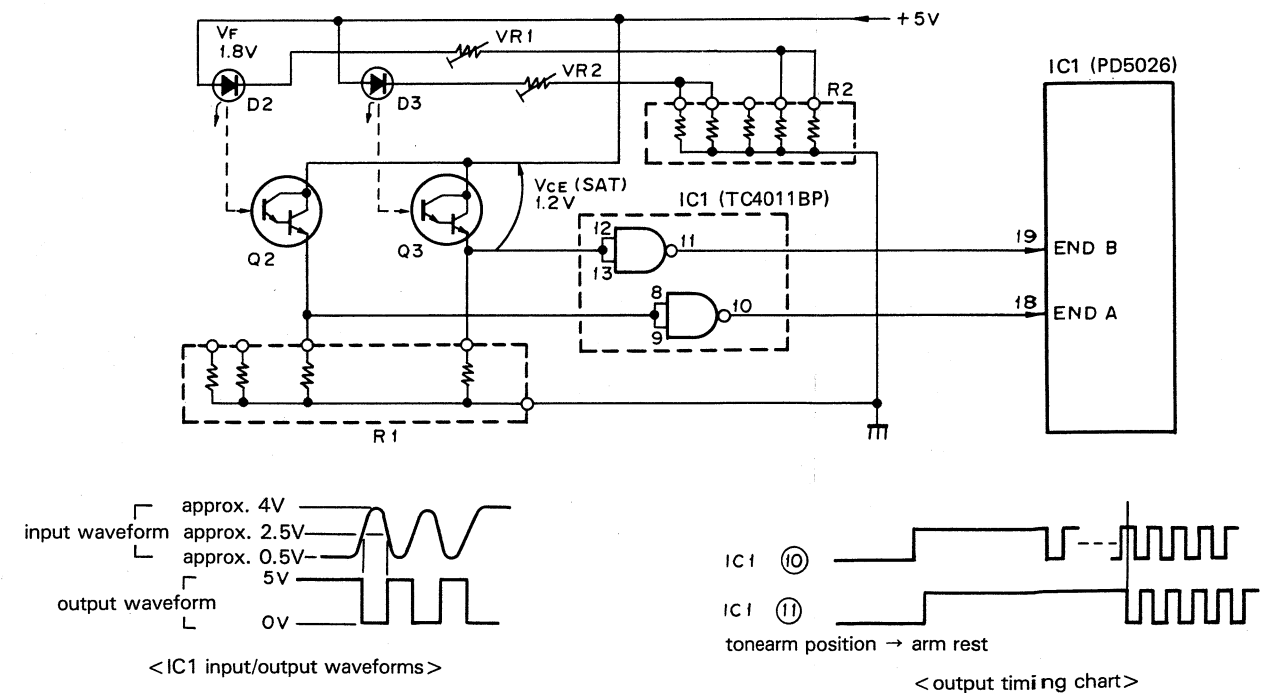


Fig. 10-6 End Sensor Assembly

# 10.5 MOTOR BLOCK

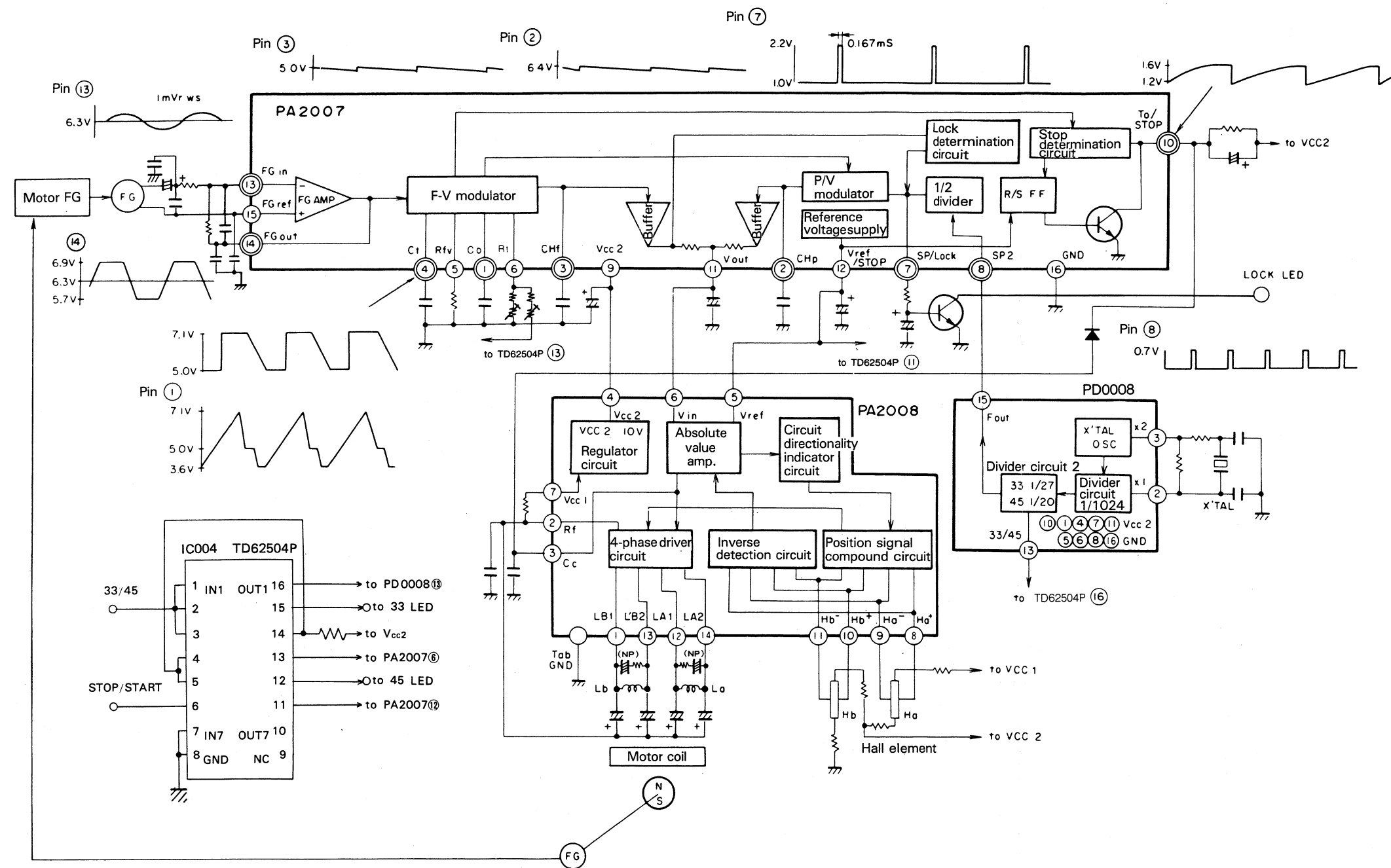


Fig. 10-7 Block Diagram

## • Simple Signal Path

The PL-90's motor drive circuitry consists of the control IC, PA2007; IC PD0008, which generates the reference phase signal; IC PA2008, which drives the motor; and IC PD62504P, which performs switching operations for the signals from the controls.

The signal obtained from the speed sensor block is amplified by the FG amplifier. Then, the speed sensor signal voltage (DC) is modulated by the F-V modulator.

As regards the reference phase voltage signal, the signal obtained from pin ⑮ of PD0008 is passed through the 1/2 divider. Then, it is modulated by the P-V modulator to produce the reference phase voltage signal (DC).

The speed sensor signal voltage and reference phase voltage are then each passed through a buffer amplifier and resistor and combined (compared). The resulting voltage is then input into the absolute voltage amplifier via IC PA2008 pin ⑥ to control the four-phase driver circuit's motor revolution voltage and thereby maintain a constant motor RPM rate.

## • Speed Sensor Block

1. There is one sensing pattern on the speed sensor circuit board.
2. Above the sensor a rotor, the lower surface of which has been magnetized to produce 400 magnetic poles, rotates. This produces an output signal that varies with the rotational speed.
3. The output signal (frequency) obtained from the speed sensor circuit board is 111Hz at 33-1/3 RPM and 150Hz at 45 RPM.
4. This output signal is then applied to PA2007 as balanced input.

## • FG Amplifier

The 20 — 160Hz band of signal obtained from the speed sensor block (output: 0.5 — 2.0mV r.m.s.) is amplified by 69dB in order to shape the waveform of the signal input into the modulator into a rectangular wave.

## • F-V Modulator

1. As the rotational speed is detected at a constant frequency, it is necessary to modulate the frequency into voltage (DC). This function is performed by the F-V modulator.
2. Previously (in the PA2004), a two-cycle F-V modulator was used, but the PA2007 uses a single-cycle F-V modulator in order to increase the control gain.
3. The F-V modulator gain does not change even when the rotational speed is switched (e.g. from 33-1/3 to 45 or vice versa).

4. The reference frequency switching mechanism is illustrated in Fig. 10-8. When the switch is OFF, the speed is fixed at 33-1/3 RPM. When the switch is ON, the 33-1/3 RPM semi-fixed resistor and the 45 RPM semi-fixed resistor form a para-connection, and the combined impedance determines the rotational speed. Therefore, after adjusting the rotational speed with the switch set to 33-1/3 RPM, it is necessary to readjust the speed with the switch set to 45 RPM. The reason for this arrangement is to prevent an unstable rotational condition from resulting when the speed switch is midway between the 33-1/3 and 45 RPM positions and both are OFF.
5. Co, Ct, Rt, Rfv are all grounded near the PA2007 ground. In the interests of noise and vibration reduction, the Rt section has a 0.01 $\mu$ F (ceramic) capacitor connected near the same place.

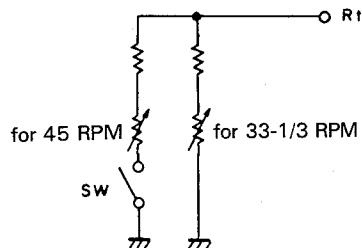


Fig. 10-8 Reference Frequency Switch

#### ● Generating the Reference Phase with IC PD0008

1. When power is turned on, the Xtal OSC block generates a 6.144MHz signal using an externally connected quartz oscillator.
2. This is then converted into a 6kHz signal by divider circuit 1 (1/1024). The resulting signal is then applied to divider circuit 2.
3. The 6kHz signal applied to divider circuit 2 is divided to 1/27 for 33-1/3 RPM and 1/20 for 45 RPM. It is then sent from pin ⑮ to pin ⑧ of PA2007.  
33-1/3 RPM: 222.2Hz  
45 RPM: 300Hz

#### ● 1/2 Divider and P-V Modulator

The signal received at pin ⑧ (see previous section) is now divided again to 1/2 by the 1/2 divider and then applied to the P-V modulator.

The P-V modulator converts the reference phase signal from the 1/2 divider into voltage (DC).

This reference phase signal which has now been modulated into DC voltage is combined with the rotation speed DC voltage with the F-V modulator (via a buffer amplifier) and is output via pin ⑪ as the motor rotation control signal. It is then sent to the absolute value amplifier via IC PA2008 pin ⑥ (Fig. 10-9).

#### ● Lock Determination Circuit

When phase control is operating, output from the F-V modulator is as shown in Fig. 10-10. If the phase lock range are set to include those portions which do not change due to increases or decreases the load torque, large variations in the rotational speed fall outside the range as shown in Fig. 10-11. Therefore, good results can be obtained by inputting the output from the F-V modulator into an absolute value comparison circuit with upper and lower thresholds. Fig. 10-12 is a theoretical circuit diagram.

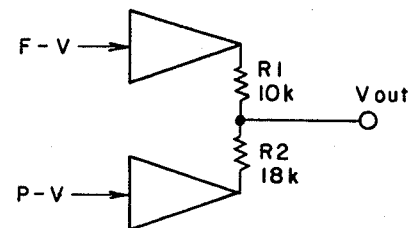


Fig. 10-9 (F-V) + (P-V) Circuit

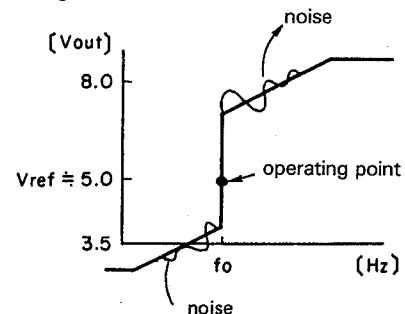


Fig. 10-10 Input/Output Characteristics

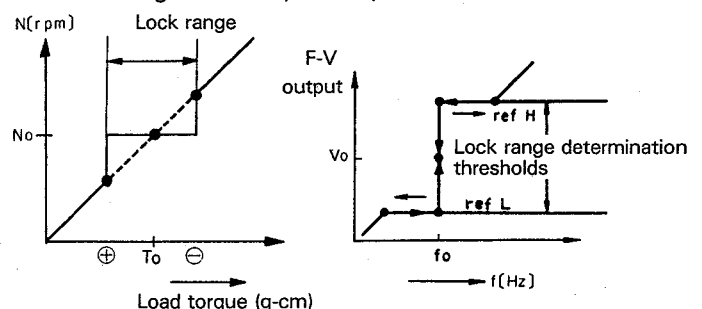


Fig. 10-11 F-V Modulator Output Characteristics

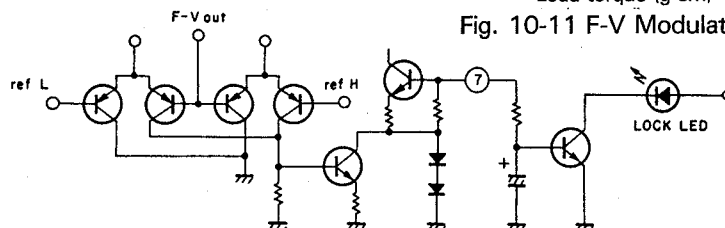


Fig. 10-12 Lock Determination Theoretical Circuit Diagram

### ● Stop Determination Circuit

1. If the PL-90's START/STOP button is pressed when the platter is turning, a stop signal is sent which triggers reverse torque. This acts as a brake on the motor, causing a sudden reduction in the rotational speed.
2. The stop determination circuit senses whether the rotational speed is high or low by means of electrical charge/discharge from C and R which are connected to pin ⑩ (To/STOP) of IC PA2007. When the rotational speed drops below a certain point, it sets motor torque to "0". Fig. 10-13 is a theoretical circuit diagram.
3. After this, the platter continues to revolve slightly due to inertia and then comes to a stop.

### ● Absolute Value Amplifier and Revolving Directional Indicator Circuit

1. The signal from pin ⑥ (control input) is compared with that from pin ⑤ (reference voltage), and the difference in voltage is used to regulate the amount of current in the motor windings. The resulting input/output characteristics are shown in Fig. 10-14.

2. When the platter rotational speed is higher than the prescribed speed, the control input is higher than the reference voltage ( $V_{ref}$  5V). When this is the case, in order to slow down the rotation of the platter, the absolute voltage amplifier sends a signal to the revolving directional indicator circuit telling it to generate reverse torque.
3. When the platter rotational speed is lower than the prescribed speed, the control input is lower than the reference voltage ( $V_{ref}$  5V). When this is the case, the absolute voltage amplifier sends a signal to the revolving directional indicator circuit telling it to generate forward (clockwise) torque in order to speed up platter rotation.

### ● Drive Circuit

1. Hall elements HA and HB (six of the rotor's magnetic poles) are situated so that electrically they form a  $90^\circ$  phase angle. This makes it possible to detect the rotor's rotational position.
2. The position detection signals from the Hall elements are input into the position signal compound circuit shown in the block diagram and waveform shaping takes place as indicated in Fig. 10-15.

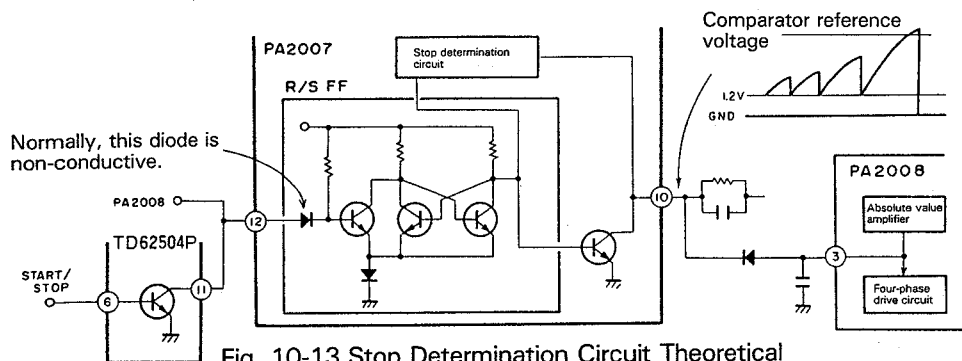


Fig. 10-13 Stop Determination Circuit Theoretical Circuit Diagram

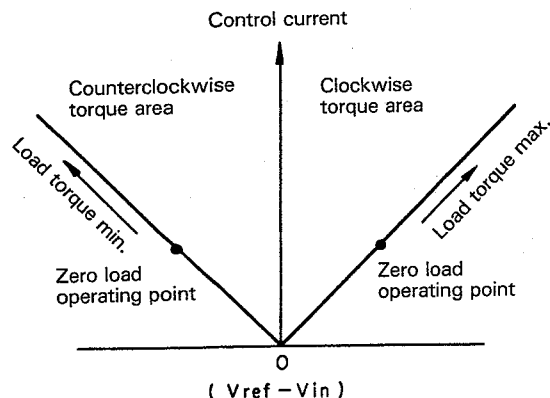


Fig. 10-14 Input/Output Characteristics

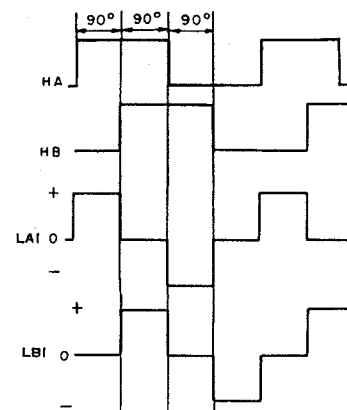


Fig. 10-15 Drive Circuit Waveforms

3. The waveform-shaped step waves are input into the four-phase drive circuit shown in the block diagram. The duty 90 voltage like that shown in Fig. 10-15 is switched alternately between LA and LB, causing the motor to turn.
4. The amplitude of LA and LB is proportional to the output from the absolute value amplifier.

#### ● Reverse Rotation Detection Circuit

1. Since the PL-90's motor has driver circuits for rotation in both directions, if the platter is manually spun the wrong way (counterclockwise), clockwise torque will be applied until the platter reaches the correct rotational speed in the correct direction.
2. However, if the platter is made to spin counterclockwise faster than 45 or 33-1/3 RPM, the rotation direction detection circuit will be fooled into thinking that the platter is revolving too fast in the correct direction, and reverse torque will be applied.
3. If reverse torque is applied when the platter is revolving counterclockwise, the result will be to speed it up even further. The platter will simply continue spinning backwards out of control.
4. A reverse rotation prevention circuit is provided to prevent this from happening.
5. The reverse rotation detection circuit consists of a single equivalent D-type FF circuit (D input moves to Q in response to CK input).

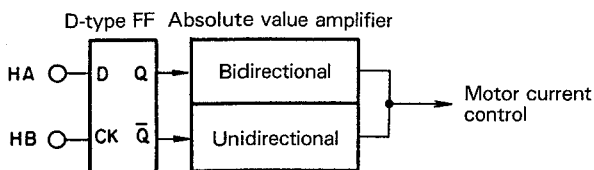


Fig. 10-16 Reverse Rotation Detection Equivalent Circuit

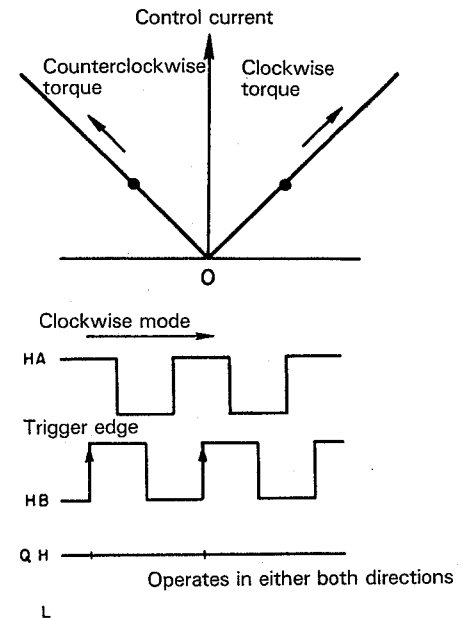


Fig. 10-17 Clockwise Rotation Mode

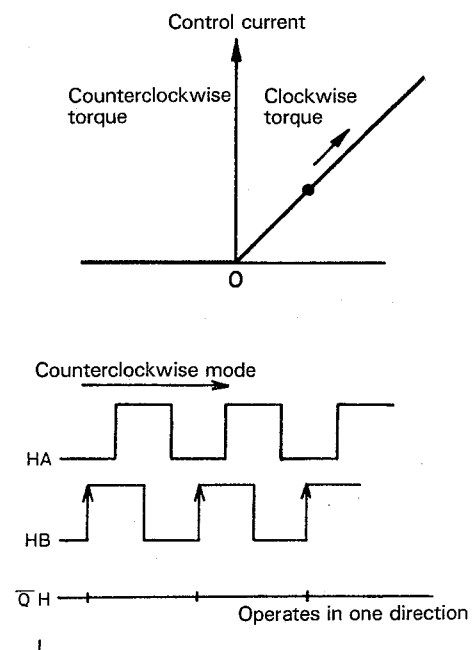


Fig. 10-18 Counterclockwise Rotation Mode